

## REMARKS

### STATUS OF THE APPLICATION

The present application was filed December 11, 2003 and included claims 1-34. In an Office Action dated May 10, 2005, the Office has rejected claims 1-34. In response thereto, Applicants have amended claim 1. In view of the amendment of claim 1 and the discussion presented herein below, Applicants believe that the application is now in condition for allowance.

### DISCUSSION

The Office has rejected claims 1-7, 12, 17-22, 27 and 32 under 35 U.S.C. 102(b) as anticipated by U.S. Patent No. 6,040,087.

Also, the Office has rejected claims 8-11, 13-16, 23-26, 28-31 and 33 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,040,087 in view of U.S. Patent No. 6,103,024.

Finally, the Office has rejected claim 34 as under 35 U.S.C. 102(b) as anticipated by or in the alternative under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 6,040,087.

Claim one has been amended to more clearly and distinctly claim the instant composite thermal hydrogen storage material. As amended, claim 1 now requires that the coating of a catalytically active metal be deposited **directly** on at least a portion of a

surface of the Mg-Ni based alloy. Any intermediate material would defeat the purpose of the composite, i.e. the thermal storage of gaseous hydrogen.

Turning now to the prior art references, and specifically U.S. Patent No. 6,047,087 (the '087 patent), there is disclosed therein an electrochemical negative electrode material. The material (in examples 1 and 2) has a core of a magnesium material, with a coating of an oxide surrounding the core of magnesium. The oxide must substantially encapsulate the magnesium material to prevent the magnesium material from being corroded during normal cycling of the battery in an aqueous alkaline electrolyte. Thus the catalytic coating is not in contact with the magnesium material directly.

The Office has further stated that the storage capacity and thermodynamics of the prior art materials of the '087 patent must be the same as those of the present invention. However, it is not true that materials made by different methods, even if they have the same composition, will have the same storage capacity or thermodynamics. The materials of the '087 patent may have vastly different storage thermodynamics, since they are made by a different method. It should be noted also that the materials of the '087 patent are made for electrochemical electrode use. It is well known in the art that the requirements of electrochemical materials is vastly different than the requirements for thermal storage materials. Particularly important is the driving force behind the storage. In electrochemical materials the driving force is an externally applied voltage. The kinetics of the reaction are driven in large part by the applied charging voltage. However, in a thermal storage material, the storage is driven by temperature. There is no electrochemical voltage which drives the storage of hydrogen in the material. The kinetics of the material are driven

completely by the thermodynamics and temperature of the material. Thus, a material which is adequate for use in an electrochemical environment, may be inadequate for thermal storage of gaseous hydrogen. There is no way to determine the thermodynamic kinetics or capacity of the storage materials of the '087 reference. In fact there is also no way to determine the storage capacity of the materials of the '087 reference at all, because no capacity number (chemical or electrochemical) have been given.

Improving (or even providing for) the low temperature thermal hydrogen storage capacity of magnesium based materials has been the end goal of many inventors for a long period of time. Had the inventors of the '087 patent improved the kinetics/capacity of thermal storage of hydrogen in the materials, such would have surely been disclosed and claimed. As it stands, no specifics on absolute storage capacity or cycle life have been disclosed. Also, the electrochemical kinetics must not have been very much improved, because the batteries were charged at C/2 (standard, relatively slow charging) and discharged at C/5 (much slower discharge), and the batteries were rested for a half hour after each charge and each discharge.

Further with respect to the hydrogen storage materials of U.S. Patent No. 6,103,024, (the '024 patent) there are no kinetics disclosed therein either. Storage capacities are specifically disclosed but these capacities are for temperatures of 300-350 °C, not for the 30 °C claimed for the instant invention. Once again, if the low temperatures kinetics/capacity for hydrogen storage at low temperatures would have been improved, such would have been disclosed and claimed, since this has long been a goal of research in this field.

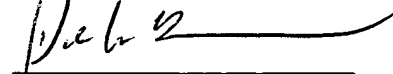
Finally, the Office has suggested that the method of manufacture of the storage material is impertinent to the overall properties thereof. This could not be farther from the truth. The structures and therefore properties of the materials can greatly depend on how the materials are made. For example, magnesium materials made by the process of example 1 of the '087 patent will have the additional elements dispersed within the original magnesium particles in locations where it is most thermodynamically stable for them to electrochemically deposit. In materials such as example 2 of the '087 patent and those of the '024 patent, the additional elements are completely randomly mixed with the magnesium material and thermodynamics plays little role in the final position of the elements. Finally, in the materials of the present invention, thermodynamics play a big role in not only the placement of the elements, but in what intermetallic compounds may be formed from the molten mixture of the elements. Further, the intense grinding of the quenched alloy further modifies the structure in that any phases that may segregate during quenching of the melt can be modified and or more intimately intermixed.

Finally, the Office has not addressed the specific microstructure of independent claim 21.

### CONCLUSION

In view of the amendment of claim 1 along with the discussion presented herein above, Applicants believe that the application is now in condition for allowance. Should the Examiner have any comments or suggestions which would place the instant application in better condition for allowance, he is earnestly requested to contact the undersigned.

Respectfully submitted,



David W. Schumaker

Reg. No 35,017

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Energy Conversion Devices, Inc  
2956 Waterview

Rochester Hills, MI 48309

Phone: (248) 299-6047

Fax: (248) 844-2273

e-mail [schumaker@ovonic.com](mailto:schumaker@ovonic.com)